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EXECUTIVE SUMMARY

This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.

BRIEF

This report describes the findings of a desk study and hydrogeological review carried out by Geotechnical and Environmental Associates (GEA), on the instructions of Crawford Partnership, on behalf of David Hudaly. The purpose of the work has been to determine the history of the site, to assess the potential for contamination, to provide preliminary information on foundation options and to review any possible impact on the local groundwater regime with respect to the proposed redevelopment of this site through the replacement of the existing structure with a four-storey apartment building. The proposed development is understood to include a lower ground floor and sub-basement level.

DESK STUDY FINDINGS

The earliest map studied, dated 1871, shows the site to be undeveloped, comprising part of an open field; however, Willow Road and Downshire Hill had already been established to the north and east of the site respectively. A number of ponds are also shown to have been present at this time, approximately 150 m to the southwest of the site. These ponds were subsequently redeveloped with housing following the establishment of Carlingford Road and Kemplay Road between 1879 and 1896.

Worsley Road, now known as Pilgrims Lane, and the surrounding streets, were established at some time between 1879 and 1895. The majority of the adjoining properties to the site were also developed over this period; however, the site remained undeveloped until some time between 1915 and 1934, when the existing building was constructed. The site has remained essentially unaltered from this time.

CONTAMINATION RISK ASSESSMENT

The desk study has shown that the site has not had a contaminative history, having been occupied by the present building for the majority of its developed history. On this basis, there is considered to be a very LOW risk of contamination: Furthermore, the proposed development and areas of associated hardstanding will cover the entire site, such that, the new usage of the site does not introduce any new receptors or pathways.

FOUNDATIONS

The Geological Survey map of the area (BGS sheet 256) indicates that the site is directly underlain by the London Clay Formation.

The foundation loads are likely to be moderately light and spread foundations bearing on the London Clay should provide a suitable foundation solution. Foundations will be required to be deepened in the vicinity of trees, or to bypass any desiccated soil. A ground investigation should be carried out to confirm the ground profile and strength of the soils. If the required founding depth to avoid tree root effects is excessive, recourse to a piled foundation solution may be required.

HYDROGEOLOGICAL ASSESSMENT

Groundwater control is unlikely to be required in excavations in order to prevent the build up of water behind retaining walls. It is not considered that the proposed development will cause adverse changes in groundwater conditions: However, a ground investigation should be carried out in order to verify the groundwater conditions at the site.

1.0 INTRODUCTION

Geotechnical and Environmental Associates (GEA) has been commissioned by the Crawford Partnership, on behalf of David Hudaly, to carry out a desk study of 45 Pilgrims Lane, London, NW3 1SR.

1.1 Proposed Development

Consideration is being given to the redevelopment of the site, through the construction of a new four-storey apartment building, which will include the construction of a lower ground floor level and additional sub-level basement beneath the eastern part of the proposed building. The sub-level basement will include space for a gym, sauna rooms and a swimming pool and will it is understood extend to a maximum depth of approximately 7.0 m below present street level.

This report is specific to the proposed development and the advice herein should be reviewed if the development proposals are amended.

1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

- to determine the history of the site and surrounding area, with respect to any previous or present potentially contaminative uses or landfills;
- to research the geology and hydrogeology of the site;
- to check records of data on ground water, surface water and other publicly available environmental data;
- to use the information obtained in the above searches to carry out a qualitative risk assessment with respect to subsurface contamination;
- to provide a preliminary assessment of the impact of the proposed development on hydrogeology; and
- to provide preliminary comments on foundation options and recommendations for appropriate ground investigation.

1.3 Scope of Work

In order to meet the above objectives, a desk study was carried out, comprising, in summary, the following activities:

- a walkover survey of the site;
- a review of readily available geological and hydrogeological maps;
- a review of historical Ordnance Survey (OS) maps publicly available environmental data sourced from the Envirocheck database; and
- provision of a report presenting and interpreting the above data, together with our advice and recommendations with respect to the proposed development.

1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the research carried out. The results of the research should be viewed in the context of the work that has been carried out and no liability can be accepted for matters outside the stated scope of the research. Any comments made on the basis of information obtained from third parties are given in good faith on the assumption that the information is accurate. No independent validation of third party information has been made by GEA.

2.0 THE SITE

2.1 Site Description

The site is located approximately 600 m to the east of Hampstead London Underground Station and 450 m to the northwest of Hampstead Heath London Underground and National Rail station. It fronts onto Pilgrims Lane to the east and is bounded by an adjoining property to the south, a double garage to the northeast and the rear gardens of properties fronting onto Willow Road to the north and west. The site may additionally be located by National Grid Reference 526930, 185830.

A walkover survey of the site was carried out on 8 March 2010 by a geotechnical engineer from GEA.

The site measures approximately 10 m by 30 m and is currently occupied by the existing building, which comprises a three-storey brick house, divided into a number of private flats, with a side access way on the northern part of the site leading to a storage shed and small garden area on the western part of the site.

The ground level slopes down in a westerly direction by approximately 2.0 m, such that on the eastern part of the site, the lower storey of the existing building forms a partial basement level accessed via a lightwell fronting onto Pilgrims Lane.

Hedgerows are present along the western boundary of the site and a mature tree, of up to 10 m in height, is present in the northwestern corner.

2.2 Site History

The earliest map studied, dated 1871, shows the site to be undeveloped, comprising part of an open field, however, Willow Road and Downshire Hill had already been established to the north and east of the site respectively. A number of ponds are also shown to have been present at this time, approximately 150 m to the southwest of the site. These ponds were subsequently redeveloped with housing following the establishment of Carlingford Road and Kemplay Road between 1879 and 1896.

Worsley Road, now know Pilgrims Lane, and the surrounding streets were established at some time between 1879 and 1895. The majority of the adjoining properties to the site were also developed over this period; however, the site remained undeveloped until some time between 1915 and 1934, when the existing building was constructed. The site has remained essentially unaltered from this time.

2.3 Other Information

A search of public registers and databases has been made via the Envirocheck database and a summary of the results of this search is included in the Appendix. More detailed information relating to the search can be provided on request.

The search has revealed that there are no active or historical landfill sites, or any waste treatment, management, transfer or disposal sites within 1000 m of the site.

The search has indicated that the site is located in an area where less than 1% of homes are affected by radon emissions; which is the lowest classification given by the Health Protection Agency (HPA) and therefore no radon protective measures will be necessary.

A single Environment Agency Recorded Pollution Incident is listed within 500 m of the site; 411 m northeast of the site. Whilst the incident has been listed as significant, it is not considered to be attributable to or to pose a risk to this site. There are no petrol or fuel stations listed within 500 m of the site.

The nearest local nature reserve is Belsize Wood, which is located 749 m to the southeast of the site. Hampstead Heath Woods Site of Special Scientific Interest (SSSI) is approximately 926 m north of the site; there are no other designated environmentally sensitive sites listed within 500 m of the site.

3.0 GROUND CONDITIONS

3.1 Soil Conditions

The Geological Survey map of the area (BGS sheet 256) indicates that the site is underlain by the London Clay Formation.

The map shows that Claygate Member is present approximately 150 m to the northwest and southwest of the site, with the Bagshot Beds, which overlie the Claygate Member, present on higher ground approximately 500 m to the west of the site

GEA have previously carried out a ground investigation in the vicinity of the current site, located approximately 160 m to the west and at an elevation roughly 10 m above the level of the current site. London Clay, comprising firm orange-brown clay, was encountered beneath a variable thickness of made ground and was proved to the maximum depth of investigation of 8.0 m. During this previous investigation, groundwater was encountered within the London Clay at depths of 3.2 m and 3.6 m.

3.2 Groundwater Conditions

The former National Rivers Authority (NRA) Ground Water Vulnerability map suggests that the site is underlain by a non aquifer, with soils of negligible permeability. The site does not lie within a nitrate vulnerable zone or a source Protection Zone (SPZ), as defined by the Environment Agency.

A figure provided in the BGS memoir showing groundwater contours in 1965 indicates groundwater beneath the site to be at a level of -35 m OD (i.e. approximately 110 m below ground level). This reflects the level of groundwater within the chalk aquifer at depth; the London Clay acts as a barrier to flow between the lower (chalk) aquifer and superficial groundwater. Perched

water is likely to be present within the Claygate Member, and other investigations carried out around the area of Hampstead Heath indicate that spring lines, reflecting the presence of perched groundwater, are present at the interface of the Bagshot Beds and the Claygate Member, and at a lower level at the boundary between the Claygate Member and the underlying essentially impermeable London Clay. These springs have been the source of a number of London's "lost" rivers, notably the Fleet, Westbourne and Tyburn, which all rose on Hampstead Heath, north of the current site, at the base of the Bagshot Beds.

The nearest surface water feature is Hampstead Ponds, located approximately 250 m to the east of the site.

On the basis of the previous investigation on a nearby site, groundwater may be encountered within the London Clay. However, due to the predominantly cohesive nature of the soils, the flow rate of any groundwater within the London Clay is unlikely to be particularly high.

The site is not within an area indicated by the Environment Agency to be at risk from flooding.

4.0 RISK ASSESSMENT

Consideration is being given to the redevelopment of the site, through the construction of a new four-storey apartment building, following the demolition of the existing block of flats. The development is understood to include the construction of a lower ground floor level and sub-level basement beneath the eastern part of the proposed building. The sub-level basement will include space for a gym, sauna rooms and a swimming pool and is understood to extend to a maximum depth of approximately 7.0 m below present street level.

4.1 Environmental Risks

Based on the findings of the desk study, the site is not considered to have had a contaminative history, having been occupied by the present building for the majority of its developed history.

No landfill sites or areas of infilled ground have been identified within 1000 m of the site and, therefore, a risk from soil gas is not envisaged.

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. As part of the new regime local authorities are required to carry out inspections of their area to identify sites that may be contaminated. The determination of contaminated sites is based on a "suitable for use" approach which involves investigating the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of establishing one or more "pollution linkages"; a pollution linkage requires a source of contamination, a sensitive target or receptor that is at risk from the contamination and a pathway by which the contamination can travel from the source to the target.

Current guidance to Local Planning Authorities (LPAs)[1] also indicates the need for a risk assessment and requires that where development is proposed on land that may be affected by contamination, a risk assessment should be carried out for consideration by the LPA before the planning application is determined. Where unacceptable risks are identified proposals need to be

[1] Planning Policy Statement 23 (2004) *Planning and Pollution Control* HMSO

made to address these risks as part of the development process. The guidance recognises the benefits of a phased approach and the desk study is the first phase in the process of investigating and identifying contamination to assist in the determination of a planning application.

This method of risk evaluation involves classification of the magnitude of the potential **consequence** (severity) and **probability** (likelihood) of the risk. The method by which these factors are classified is detailed in the Appendix.

On the basis of the consequence and probability the site can be attributed a level of risk, ranging from very low to very high and the procedure for making this assessment is shown in the Appendix, together with a description of each level of assessed risk and the actions that may be required to mitigate the risk.

The desk study has not identified any potential sources of contamination, such that, no potential pollutant linkages can be made. There is therefore considered to be a VERY LOW risk of contamination. It would, however, be prudent to recover a limited number of samples for contamination testing as a precautionary measure, during any future ground investigation required to determine the ground conditions and provide information for the design of suitable foundations,. If elevated concentrations of contaminants are identified within the soil, further investigation and/or remediation may be required in areas of proposed garden or soft landscaping.

4.2 Development Issues

The proposed redevelopment of the site includes demolition of the existing buildings and construction of a new four-storey apartment building, which will include a lower ground floor level and sub-level basement beneath the eastern part of the proposed building. The sub-level basement will include space for a gym, sauna rooms and a swimming pool and is understood to extend to a maximum depth of approximately 7.0 m below present street level.

The foundation loads are likely to be moderately light and spread foundations bearing on the London Clay should provide a suitable foundation solution.

Groundwater inflows may be encountered in the basement excavations; however, shallow inflows are likely to be the result of perched water within any made ground present on the site and in the vicinity of existing foundations and are therefore unlikely to be significant. Deeper inflows may also be encountered from silt or sand horizons present within the London Clay, although the likely flow rates of such inflows are likely to be low.

Excavation of the sub-basement level will create a potential for some heave of the underlying clay soils, although it is anticipated that this will be largely mitigated by the addition of loads during construction. The London Clay is likely to be of high volume change potential and, therefore, foundations will need to be deepened in the vicinity of existing or proposed trees in accordance with NHBC guidelines, and to bypass any zone of desiccation. Should this result in excessive founding depths recourse to a piled foundation solution may be considered.

4.3 Hydrogeological Assessment

The current development proposals include construction of a sub-level basement beneath the eastern part of the site, which will extend to a depth of approximately 7.0 m below present street level.

The desk study research has indicated that groundwater may be present within the London Clay; however, as groundwater flow within the London Clay is unlikely to be significant and the proposed basement structure will not act as a barrier to flows by filling space laterally, it is not considered that this would have any significant influence on the local hydrogeology.

However, an accurate assessment of the groundwater level and direction of flow is necessary in order to detail if any groundwater control measures will be required, in order to protect against flooding of the new structure and prevent a build up of water pressure on its upstream side.

5.0 CONCLUSIONS

Consideration is being given to the redevelopment of this site through the demolition of the existing buildings and construction of a new four-storey apartment building, which will include a lower ground floor level and sub-level basement beneath part of the footprint of the proposed building.

On the basis of the findings of the research carried out there is considered to be a VERY LOW risk of contamination at this site. It would, however, be prudent to carry out chemical analyses on samples of the near-surface soil in order to determine whether any contaminants are present and to provide an assessment of classification for waste disposal purposes.

The expected ground conditions at the site indicate that spread foundations bearing on the London Clay should be a suitable solution for the anticipated moderately light loads from the proposed new development. Foundations will, however, need to be deepened in the vicinity of trees and to bypass any desiccated soil, and if this results in excessive founding depths recourse to a piled foundation solution may need to be considered.

It is not considered that the proposed redevelopment of the site will cause adverse changes in groundwater conditions. A ground investigation should, however, be carried out in order to verify the groundwater conditions at the site.

It is recommended that a ground investigation is undertaken in order to determine the ground and groundwater conditions at the site, to assess the presence of soil contamination and to provide recommendations for the design of suitable foundations and retaining walls. The scope of an appropriate ground investigation would include: a series of shallow boreholes to enable visual inspection of the soil and collection of samples; installation of standpipes and subsequent monitoring of groundwater levels; laboratory geotechnical classification tests on samples of the soil; and laboratory chemical analyses on selected samples of the shallow soil, to assess the presence of contamination and to provide an indication of waste classification. Depending on the required founding depths to protect against desiccation there may also be a requirement for a limited number of deeper boreholes to provide pile design parameters.

APPENDIX

Envirocheck Summary Report

Historical Maps

Risk Assessment Tables